

Analyzing, developing, and testing standard operating procedures in a virtual environment: a case study using the Enhanced Dynamic Geo-social Environment First Responder Sandbox virtual training platform

Abstract — This paper presents an innovative way to develop and train standard operating procedures (SOPs) for first responders using virtual training. Virtual training provides a safe, repeatable environment to simulate SOP implementation in real-world situations. SOPs are the foundation of how first responders train for, and respond to, emergencies. SOPs are typically born of experience over time which can be both slow and backward looking. Given today's world of changing and evolving threats that may involve multiple agencies or other civilian responders, SOPs often need to be more dynamic than traditional development allows. Given this, how can SOP issues be better assessed and corrected when "put to the test" only during live training or emergencies? The Enhanced Dynamic Geo-social Environment (EDGE) First Responder Sandbox (FRS) software, a virtual environment where scenarios can be re-run multiple times to assess and analyze the efficacy of existing, updated, or new SOPs, was used for this study.

1 SOP development and analysis (a historical perspective)

First responders, much like the military, rely on standardized practices for the execution of their jobs. For first responders and others, almost every aspect of their job is defined by SOPs. From the most mundane of tasks, to the most complex of tasks, there is most likely a SOP that dictates the details or parameters of how the task is to be accomplished. For law enforcement, it could be whether first on scene pursues or waits for additional officers, whether they proceed in a diamond or a two-man bump, or how to clear a building. For Fire, Rescue and EMS personnel, it could be how to establish a casualty collection point (CCP), how to attack a fire, or how to evacuate people in a hostile environment. For educator's, it could be when situations dictate to go on full lockdown, whether to shelter in place or run-hide-fight, or how to barricade a door. Regardless of the role, these professionals are governed by the SOPs of their jurisdiction.

In general, SOPs are best practices that have been honed over long periods of time based on the advice of experts and the experience(s) of those involved in their development. Most often, SOPs are documented in written processes and procedures, but they may also be presented through training materials or training demonstrations. But how is their efficacy analyzed and assessed? Even with ongoing paper reviews of SOPs, until they can be tested during an actual emergency or live training event, they remain essentially theoretical. Subsequent to an event, organizations usually conduct a "hot wash" or "After Action Review (AAR)" to analyze what went right and what went wrong in order to update or revise existing SOPs. In some cases the AAR may indicate the need for a new SOP to cover an identified gap. As the events that drive these types of reviews are often infrequent, and often colored by political realities, the analysis and update process can take an extended period of time to complete. In addition, these reviews are backward looking which can result in SOP updates that are reactive rather than proactive.

2 Changing threats create the need for a better solution

Over the past few decades, the threat landscape has changed and evolved. The tactics employed by terrorists and other perpetrators are now often presenting responders with situations which they either have not been trained for, or have not been adequately trained for. Not only are these new threats changing the threat landscape, they also appear to be changing at a more rapid pace than they did historically. To complicate matters further, there was a noted shift from more traditional to softer (civilian) targets during this period, a trend that does not seem to be abating.

In light of this, the traditional process for vetting and updating SOPs, being relatively slow and reactive could prove to be ineffective to evolving threats. By the time the SOPs are revised, re-tested, and re-implemented, the threat landscape may have changed enough to make the new procedures moot. The new landscape requires a process that is more forward looking, proactive, and allows for development, testing, and refinement of SOPs in a more rapid fashion. Virtual training appears to provide an ideal environment for this type of rapid SOP development.

3 Finding the right virtual training tool for SOP development and assessment

When the Department of Homeland Security (DHS) Science and Technology (S&T) Directorate analyzed the 2008 Mumbai attacks, it highlighted the need for a cost-effective, multi-agency virtual training environment where SOPs could be practiced and analyzed to ensure complex emergency events are met with efficient, coordinated responses. To achieve this, DHS S&T developed a list of attributes that this type of training system needed to have in order to meet the objectives. These included: no hard coded tactics (i.e. tactics agnostic), many simultaneous trainees in the environment, minimize the ability to "game" the training, minimize impacts of artificial intelligence (AI) that may limit scenario variants or present

other constraints, maximize training repeatability, and a robust replay or after action review (AAR) system with multiple views and start/stop/rewind/fast forward capabilities. After a survey of existing software and not finding anything that met their needs, DHS S&T collaborated with the U.S. Army and industry partners to extend the Army's existing Enhanced Dynamic Geo-Social Environment (EDGE) platform for the purposes of developing virtual training tool that would meet the established needs. The end result was the EDGE First Responder Sandbox (FRS) software tool.

The initial release of EDGE FRS (v1) was centered on a 26-story hotel focused on first responder training. Subsequent to this release, DHS S&T determined the need for FRS v2 to meet changing threats. FRS v2 is a school environment that involves first responders, educators and administrators. The key design attributes mentioned previously, are cornerstones of both FRS versions and vital to using EDGE for SOP development and analysis.

4 Study - Using EDGE to assess viability of virtual training for SOP analysis, development, and training

To demonstrate how first responder, civil security, and other civilian agencies can benefit from virtual training, a generalized training flow was developed and employed across several training groups utilizing both the FRS v1.x and v2.0 (Beta) training environments. This flow included: a basic introduction to the software, guided hands-on "free play" for trainees to get comfortable with the controls in the environment, and training sessions that were followed by an AAR session. The training/AAR session was repeated with scenarios escalating from simple to complex iteratively as time allowed.

The AAR period was an instructor-guided session with probing questions related to the specific actions taken and their relationship to current SOPs, evaluation of the effectiveness of those actions, and identification of possible changes that could lead to better outcomes/results. Depending on the results of the AAR, the scenario could either be replayed in the subsequent training session using different actions, or a different scenario could be used for the subsequent session.

The observational data for the case analysis has been gathered from multiple training and test events, demonstrations, and discussions with first responders, educators, and trainers. These events include both the FRS v1.x (Hotel) and v2.0-Beta (School) environments.

Summary/Conclusions/Next Steps

Our initial analysis shows that following an initial learning period where trainees are becoming familiar with the mechanics of using the EDGE FRS tool and becoming comfortable with "playing their roles" within the virtual environment, they begin to immerse themselves in the training and act as they would in the real world. Once this occurs, training becomes extremely effective producing results mirroring how real events would unfold. It is at this

point, through the use of the AAR tool and the associated discussions, that SOPs can be most effectively analyzed. The AAR process brings the discussion of SOP effectiveness from the theoretical to the actual and provides the opportunity for the trainees to highlight and address both effective and ineffective aspects of the employed SOP based on what occurred within the virtual environment. These exercises can also expose gaps in existing SOPs or understanding of SOPs. This can result in SOP adjustments that can be immediately practiced and tested. In the case where new SOPs are developed over time to best address the issues, they can be developed and assessed during future training days through comparison against the original AAR that identified the issue.

The next steps to continue to validate the findings include following several individual agencies over time to assess their use the EDGE software and how, specifically, they are monitoring and evolving their SOPs through the use of the tool. The results could then be collectively compared to assess the overall efficacy of a virtual environment tool for SOP management.

Author Biographies

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